REMARKS

In the Office Action mailed May 5, 2000, the Examiner indicated that the declaration was defective and indicated that a new declaration is required. Upon receiving notification that the application contains allowable subject matter, Applicants will prepare and file a supplemental declaration.

The Examiner also objected to the section under the header "Brief Description of the Drawings" and to the Abstract. By this paper, Applicants have amended both of these sections to correct the problems identified by the Examiner. In particular, a description of each of the drawings has been added to the section "Brief Description of the Drawings." The Abstract has been amended to provide examples of the reducing agent and catalyst. Applicants respectfully submit that it is clear from the abstract that oxygen is the impurity to be removed from the nitrous oxide gas.

The Examiner then objected to Claims 1, 2, 3, 18, 26 and 27 for various reasons. By this paper, Applicants have been each of these claims to overcome the objections raised by the Examiner.

The Examiner then rejected Claims 1-30 under 35 U.S.C. § 112, second paragraph as being indefinite. First, the Examiner indicated that Claim 1 does not particularly point out and distinctly set forth what the gas is being purified from. Applicants respectfully submit that in view of the amendments that have been made to Claim 1, it is now clear that O_2 is being removed from the nitrous oxide gas.

The Examiner then indicated that Claims 2, 4, 6, 12, 13, 20, 22, 23 and 29 were vague and indefinite because of the use of the phrase style "comprises XY or Z." Applicants respectfully submit that in view of the amendments that have been made to the claims, the

meaning of each of these claims is readily apparent. Claim 2 has been incorporated into Claim 1 and is now written in standard Markush format. In Claim 4, the inert can be either water, carbon dioxide or a mixture thereof depending upon the reducing agent that is used to react with oxygen. Applicants submit that one of skill in the art would know what inert compounds would be formed by the reaction of oxygen with a reducing agent. Claim 6 as amended indicates that the nitrous oxide gas can additionally contain any of the listed gases. Claims 12 and 13 have been rewritten in standard Markush format. Similar changes have been made to Claims 20, 22, 23 and 29. Additionally, Claim 1 has been amended to more clearly indicate that O_2 is a contaminant that is removed. Applicants request reconsideration of these claims in view of the amendments that have been made.

The Examiner then rejected Claims 1, 4-7, 12 and 28-30 under 35 U.S.C. § 102(b) as being anticipated by German patent document 83,974. By this paper, Applicants have amended Claim 1 to indicate that the reducing agent is selected from the group consisting of hydrogen, carbon monoxide, ammonia and mixtures thereof. The reducing agent disclosed in the Abstract of the German reference is hydroxylamine. Accordingly, Applicants respectfully submit that Claim 1 is not anticipated by this reference. Additionally, Applicants submit that it would not have been obvious since the hydroxylamine is used to react with the various components to form additional nitrous oxide. In the present application, the reducing agent is used simply to remove oxygen from the gas mixture without significantly reducing the amount of nitrous oxide present. Claims 4-7 and 12 which all depend from Claim 1 are distinguishable for the same reasons. Additionally, Claim 28 indicates that the NOx reacts with ammonia not the hydroxylamine disclosed in the German reference. Accordingly, Applicants submit that Claims 28-30 are not anticipated and would not have been obvious in view of this reference.

Claims 1-30 were then rejected under 35 U.S.C. § 103(a) as being unpatentable over the German patent document No. 83,974 in view of Matsuda et al. (No. 4,351,811). As discussed above, the German reference teaches the use of hydroxylamine to form nitrous oxide. It is not directed to the purification of a nitrous oxide stream utilizing the reducing agents claimed in the present application. Accordingly, Applicants respectfully submit that it would not have been obvious to combine the teachings of Matsuda et al. with the German reference to obtain Applicants' invention.

In view of the foregoing, Applicants respectfully submit that the claims are now in condition for allowance and prompt favorable action by the Examiner is requested. Should the Examiner find any impediment to the prompt allowance of the claims which could be corrected by a telephone interview with Applicants' attorney, the Examiner is requested to initiate such an interview with the undersigned.

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Respectfully submitted,

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a graph of the percent oxygen destruction versus hydrogen flow in the process of Example 1.

Figure 2 is a graph of the percent nitrous oxide destruction versus hydrogen flow of the process of Example 1.

Figure 3 is a graph of oxygen destruction selectivity versus hydrogen flow of the process of Example 1.

Figure 4 is a graph of the percentage of oxygen destruction versus hydrogen flow of the process of Example 2.

Figure 5 is a graph of the percent of nitrous oxide destruction versus hydrogen flow of the process of Example 2.

Figure 6 is a graph of oxygen destruction selectivity versus hydrogen flow of the process of Example 2.

MARKED UP VERSION OF CLAIMS

1. (Amended) A method for purification of a nitrous oxide gas containing O_2, said method comprising;

feeding said nitrous oxide gas and a reducing agent selected from the group consisting of hydrogen, carbon monoxide, ammonia and mixtures thereof into a de-oxidation reactor;

performing de-oxidation by reacting said reducing agent with O_2 [oxygen] using a de-oxidation catalyst to form an inert, in order to deplete said O_2 [oxygen] in said nitrous oxide gas, while limiting the amount of nitrous oxide removed from said nitrous oxide gas.

3. (Amended) A method according to Claim 1, wherein said reducing agent is [a] hydrogen [containing gas].

4. A method according to Claim 1, wherein said inert comprises water[,] or carbon dioxide [or nitrogen].

6. (Amended) A method according to Claim 1, wherein said nitrous oxide gas further comprises NOx, nitrogen, carbon monoxide, carbon dioxide or organic compounds.

10. (Amended) A method according to Claim 9, wherein said off-gas comprises between 1000 ppmv and 10 vol. % O_2 [oxygen], and between 100 ppmv and 1% NOx.

11. (Amended) A method according to Claim 1, wherein up to 99 vol. % of [oxygen] said O_2 is removed from said nitrous oxide gas.

12. (Amended) A method according to Claim 1, wherein said de-oxidation catalyst is selected from the group consisting of [comprises] palladium, platinum[, or] and mixtures thereof.

13. (Amended) A method according to Claim 7, wherein said selective catalytic reduction catalyst is selected from the group consisting of [comprises] oxides of vanadium, titanium[, or] and mixtures thereof.

18. (Amended) A method according to Claim 7, wherein prior to [and subsequent to] said selective catalytic reduction, an oxygen containing gas is passed over said selective catalytic reduction catalyst.

19. (Amended) A method for purification of a nitrous oxide gas comprising;

feeding [said] an O_2 and NOx containing nitrous oxide gas and ammonia or a precursor thereof into a reactor system;

performing selective catalytic reduction by reacting said ammonia or precursor thereof with NOx in said nitrous oxide gas using a selective catalytic reduction catalyst;

feeding a reducing agent into said reactor system;

performing de-oxidation by reacting said reducing agent with [oxygen] O_2 in said nitrous oxide gas using a de-oxidation catalyst.

20. (Amended) A method according to Claim 19, wherein said nitrous oxide gas further comprises NOx, nitrogen, carbon monoxide, carbon dioxide or organic compounds.

22. (Amended) A method according to Claim 19, wherein said de-oxidation catalyst is selected from the group consisting of [comprises] palladium, platinum [or] and mixtures thereof.

23. (Amended) A method according to Claim 19, wherein said selective catalytic reduction catalyst is selected from the group consisting of [comprises] oxides of vanadium, titanium[, or] and mixtures thereof.

26. (Amended) A method according to Claim 19, wherein prior to [and subsequent to] said selective catalytic reduction, an oxygen containing gas is passed over said selective catalytic reduction catalyst.

27. (Amended) A method according to Claim 19, wherein recovery of nitrous oxide from said nitrous oxide gas utilizing said reactor system [comprises] is greater than 95%.

28. (Amended) A method for purification of a nitrous oxide gas comprising;

feeding an NOx containing [said] nitrous oxide gas and ammonia or a precursor thereof into a reactor system;

performing selective catalytic reduction by reacting said ammonia or precursor thereof with NOx in said nitrous oxide gas using a selective catalytic reduction catalyst; while limiting the amount of nitrous oxide removed from said nitrous oxide gas.

29. (Amended) A method according to Claim 28, wherein said nitrous oxide gas further comprises [NOx,] nitrogen, carbon monoxide, carbon dioxide or organic compounds.

ABSTRACT

A method for purification of an oxygen ~~containing~~ contaminated nitrous oxide gas by feeding the nitrous oxide gas and a reducing agent such as hydrogen, carbon monoxide or ammonia into a de-oxidation reactor, performing de-oxidation by reacting the reducing agent with oxygen using a catalyst such as palladium or platinum in order to deplete the oxygen in the nitrous oxide gas, while limiting the amount of nitrous oxide removed from the nitrous oxide gas.